Metalith H_2O™ Summary of Laboratory Testing

By Don Ward, ERDC-CHL, April 10, 2008

The Metalith H_2O™ flood fighting barrier is manufactured by Infrastructure Defense Technology, LLC (IDT). The barrier is constructed of standard corrugated aluminum sheet panels used for siding and roofing. The panels are modified to fit together with pins to form a series of boxes which are then filled with sand or other material (Figure 1).

Figure 1. The Metalith H_2O™ flood fighting barrier.

The basic Metalith H_2O™ was installed by a 4-man crew from IDT, plus two small front-end loaders with operators to fill the units. The 70-ft long by 3-ft high by 4-ft wide barrier was assembled in 26 min. After 42 min, the barrier was securely fastened to the wingwalls, all corners had been covered with plastic sheeting, and the wall was ready for sand. Total time to this point was 2.8 man-hrs.

The time required to fill the units with sand is obviously dependent on the type of loading equipment and the distance from the sand source to the barrier wall. Using two small front-end loaders with a 4-man crew to tamp the sand (or 1 front-end loader with a 2-man crew when one of the loaders was unavailable) and the sand source located outside the test basin, the total time to fill with sand was 7.6 man-hrs.

An additional 1.7 man-hrs was spent in final sealing of the units and joints, for a total construction time of 12.1 man-hrs.

With a one-ft hydrostatic head in the basin, seepage rate under and through the barrier wall was 0.13 gallons per minute per linear foot of wall (gpm/lft). While this rate of seepage is not unreasonable for a temporary barrier to raise a levee and protect farm lands, IDT chose to seal the units to the floor of the basin with a tar-like roofing caulking to reduce the seepage rates. The caulking was applied around the base of the units on the exterior walls, and in the corners, pin holes, and joints. The 4-man crew spent 1 hr 24 min (5.6 man-hrs) sealing the barrier. When the sealing time was added to initial construction time, the total was 13.2 man-hrs.

Seepage rate with the 1-ft hydrostatic head test was 0.046 gpm/lft. Seepage rates were 0.146 gpm/lft and 0.260 gpm/lft for the 2-ft and 95%H (34.7 in.) hydrostatic tests, respectively.

There was no discernable movement of the barrier during tests with wave action, although the expanding foam seal in one corner was blown out during the test with medium waves at high water level, and again during the large waves. The corner seal was replaced with a block of Styrofoam cut to fit the contours of the panels.

Some sand was washed out of the top of the units during the overtopping test, but the damage was not progressive and there was no other observed damage.

The debris impact tests dented the front panel of the structure and caused the front to move on the order of 0.25 in. There was no other observed damage.

The basic unit with additional caulking was removed and replaced with a barrier made of the same type of aluminum panels but with additional steps taken to minimize leakage. These additional steps included the use of rubber gaskets in the pin holes, Styrofoam blocks cut to fit the contours of the panels in the

corners, foam pipe insulation fitted over the bottom of the front panels to form a seal with the floor, and the use of flashing along the front to improve the seal. The enhanced units reduced the seepage to 0.02 gpm/lft at a 1-ft head, 0.04 gpm/lft at a 2-ft head, and 0.06 gpm/lft at 0.95H.

Table 1 gives a summary of test results of the basic units, basic units with caulking, and the enhanced units.

Table 1. Summary of Tests with Metalith H_2O™.

Test	Basic Units	Basic Units with Additional Caulking	Enhanced Units
Construction/Repairs/Disassembly			
Construction (man-hrs)	12.13[1]	17.73	23.18[2]
Repairs (man-hrs)	n/a	0.92	1.52
Disassembly (man-hrs)	n/a	4.98	5.70
Hydrostatic Seepage Rates (gpm/lft)			
1 ft Head	0.13	0.05	0.02
2 ft Head	n/a	0.15	0.04
0.95H Head	n/a	0.26	0.06
Hydrodynamic Tests			
0.67H depth			
Small Wave	n/a	No damage	n/a
Medium Wave	n/a	Minor sand loss	n/a
Large Wave	n/a	Minor sand loss	n/a
0.80H depth			
Small Wave	n/a	Minor sand loss	n/a
Medium Wave	n/a	Loss of foam sealant in one corner (no repair)	n/a
Large Wave	n/a	2nd loss of foam sealant in same corner (repair)	n/a
Log Tests			
12 in. Log	n/a	Dented but not torn	n/a
16 in. Log	n/a	Dented but not torn	n/a
Overtopping	n/a	Minor sand loss	n/a
Riverine Current	n/a	n/a	No damage

Notes:
[1]Ready for sand fill in 2.80 man-hrs.
[2]Ready for sand fill in 6.20 man-hrs.

Other Factors

Costs

Cost of the units as provided by IDT in July 2007 was $40/ft for the basic units (3 ft high by 4 ft wide), or $50/ft for the minimal-seepage configuration.

Constructability and Re-usability

The units were placed without any specialized equipment. The only mechanized equipment used was a small front-end loader/forklift. Because no large equipment or machinery is required, the units could be placed in an area with a minimum right-of-way or over surfaces not suited to heavy equipment.

Equipment used, in addition to the front-end loader/forklift, included shovels, wire cutters, hammer, caulk gun, trowel/putty knife, c-clamps, and box knives.

In addition to the sand, supplies required included silicon sealer, plastic sheeting, expanding foam, and duct tape. The tests with additional caulking also required the caulking both in gallons and in caulking tubes, and the minimal seepage test required flashing placed around the base.

The units were approximately 90 percent re-usable, although some cleanup of the units to remove caulking and sealant is required for re-use. A few of the wall panels were damaged during removal and some work is required to repair minor bends in the panels.

No attempt was made to stack units to raise the working depth of the barrier. If the pool in front of an installed barrier is in danger of exceeding the maximum design depth of the units, it may be necessary to install a second row with units designed for greater depths.

Environmental

The aluminum panels are environmentally inert and do not require disposal due to their re-usability. Damaged units being thrown out may be taken to any aluminum recycling center for recycling.

The sand placed within the units will pick up any contaminants carried by the flood waters. In addition, as the sand was removed from the units during disassembly, pieces of plastic sheeting, Styrofoam, foam insulation, and tar (depending on the units being tested) were picked up with the sand and dumped

in the refuse pile. For these reasons, special disposal of the sand may be required.

The small amount of caulking used on the basic units and the minimal seepage units is not considered to be a serious environmental threat. However, the units tested with additional caulking required about 10 gallons of tar that remained in chunks and pieces and required considerable cleanup. Several gallons of mineral spirits were used to remove the tar that remained on the floor of the basin. Both the tar and the mineral spirits are considered an environmental concern. The units are marketed only as the basic units or the minimal-seepage units, both of which pose little or no hazard.

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